

**ORIGINAL**

**OPEN MEETING**

**MEMORANDUM**



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**RECEIVED**

TO: THE COMMISSION

2010 MAR 16 P 4:43

FROM: Utilities Division

AZ CORP COMMISSION  
DOCKET CONTROL

DATE: March 16, 2010

RE: TUCSON ELECTRIC POWER COMPANY-APPLICATION FOR APPROVAL OF ITS PROPOSED ZERO-NET ENERGY HOMES PILOT PROGRAM (DOCKET NOS. E-01933A-07-0402 AND E-01933A-05-0650)

**BACKGROUND**

On June 30, 2009, Tucson Electric Power Company ("TEP" or "Company") filed an application for approval of its proposed Zero-Net Energy Homes ("ZEH") Pilot Program. The proposed ZEH Pilot Program expands on the current New Home Construction Program, marketed as the Guarantee Homes Program ("GHP") and approved by the Commission on August 6, 2008 (Decision No. 70458). In Decision No. 70628, the Commission required TEP to "build on its current residential energy efficiency program and prepare a report and proposed pilot project [and]...outline what Zero-Net technologies and incentives...can be incorporated into the Company's existing DSM programs."

**PROGRAM DESCRIPTION**

TEP's proposed ZEH Pilot Program which is an expansion of the current New Home Construction Program ("Tier 1") incorporates two new tiers: Tier 2-Energy Efficient Home Construction ("Tier 2") and Tier 3-Near Zero-Net Energy Homes ("Tier 3") into the existing New Home Construction Program. According to TEP, incorporating the two additional tiers will help keep the program administrative costs down. TEP intends to merge the ZEH Pilot Program with the existing GHP. According to the proposed Program, homes will qualify for one of the three tiers in the program based on a Home Energy Rating System ("HERS")<sup>1</sup> Index score. The HERS awards a numerical value for gauging a home's performance. Higher performing homes achieve a lower HERS score. Tier 1 requires a HERS score that is less than or equal to 85, Tier 2 will require a HERS score that is less than or equal to 70, and Tier 3 will require a HERS score that is less than or equal to 45. Table 1 illustrates the HERS Index Scores for the Residential New Home Construction Program.

Arizona Corporation Commission

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<sup>1</sup> The HERS Index was developed by the Residential Energy Service Network.

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Table 1

Tier 1 (Existing Program)	HERS Index Score of $\leq 85$
Tier 2 (Energy Efficiency Only)	HERS Index Score of $\leq 70$
Tier 3 (50% Zero-Net Energy)	HERS Index Score of $\leq 45$

The proposed ZEH Pilot Program design will allow TEP to use existing delivery infrastructure and marketing to promote all three program tiers. According to TEP, although the proposed addition of Tier 2 and Tier 3 would improve the energy efficiency of the New Home Construction Program, they do not achieve 100 percent zero-net energy due to cost-effectiveness concerns. TEP defines the term *zero-net energy* as "the ratio between annual energy generated by the house through the on-site renewable devices to the total annual energy used by the house." Therefore, a home is considered to be a 75 percent ZEH if 75 percent of the total annual energy a home uses (including energy from both gas and electric for dual fuel homes) comes from on-site generation.

TEP's existing residential New Home Construction Program currently offers three options; the Guarantee Homes Program ("GHP"), the Guarantee Solar Program ("GSP"), and the Energy Star® Program ("ESP"). TEP anticipates that the GSP will be replaced by the new Tier 3 option.

According to TEP, with the addition of the new Tier 2 and Tier 3 options, there will be additional construction standards in order for builders to achieve Tier 2 and Tier 3. As a result, the incremental costs for builders will increase to meet the increased standards for Tier 2 and Tier 3 as well as the recommended incentive to the builders. Table 2 illustrates the proposed ZEH Pilot Program Builder Incentives. The additional construction standards for Tier 2 and Tier 3 homes include:

- Greater envelope and Heating, Ventilating, and Air Conditioning ("HVAC") energy efficiency standards;
- Ducts are located within conditioned space;
- Both photovoltaic ("PV") and solar water heating on the ZEH;
- Passive solar design that incorporates passive solar heating in the winter and shading in the summer for the highest efficiency homes;
- Energy Star® fixed appliances; and
- Compact Fluorescent Lamps ("CFLs")

Table 2

ZEH Tier Level	HERS Index	Builder Incentive
Tier 1 (Existing Program)	$\leq 85$	\$400 per home
Tier 2 (Energy Efficiency Home)	$\leq 70$	\$1,500 per home
Tier 3 (50% Zero-Net Energy Homes)	$\leq 45$	\$3,000 per home

According to information provided by TEP, the additional \$1,500 above Tier 2 incentive paid to builders for Tier 3 from this program will be in addition to the incentives paid from TEP's REST Program. Despite the addition of the \$1,500 increase in incentives between Tier 2 and Tier 3, the total incentives paid for Tier 3 will not exceed the sixty percent (60%) cap approved in its 2010 REST Implementation Plan (Decision No. 71465). TEP indicated that builders would not pursue the available federal and state tax credits for PV and solar water heaters as they may not be eligible to receive those credits because the builder would not be the actual owner of the home. In addition, TEP indicated that the actual home owner would be eligible to pursue the available federal and state credits for PV and solar water heaters. Therefore, TEP chose to increase the incentive levels for those builders who invested in the construction of a home that qualifies for the Tier 3 level (HERS  $\leq 45$ ) because the builder may not be able to qualify for the available federal and state tax credits for solar technologies.

### **TARGET MARKET**

According to TEP, the target market for the ZEH Pilot Program is new homes within TEP's service territory. TEP intends to market the ZEH Pilot Program to all builders within its service territory. The tiered program approach allows TEP to promote the Tier 2 level of the ZEH Pilot Program for homes that are constructed with a combination of electric and natural gas.

Because the ZEH Pilot Program does not achieve a true zero-net energy level and is designed for a 50 percent zero-net energy level (Tier 3), the size of the PV system built would need to be large enough to produce at least 50 percent of the total energy (gas and/or electric) used in the home. In addition, TEP states that if a home is designed with gas water heating and gas heating to meet the 50 percent zero-net energy level (Tier 3), then a gas/electric home would qualify as a Tier 3 level home. This home would also qualify for the Tier 3 incentive level payments. TEP stated that it chose to focus its marketing on an all electric option for Tier 3. However, Staff believes that for Tier 3 that TEP's marketing efforts should include gas/electric homes.

### **PROGRAM OBJECTIVES**

The objectives of the ZEH Pilot Program are the following:

- Reduce peak demand and overall energy consumption (electric) in new homes;
- Implement programs that include more aggressive energy efficiency standards that produce savings of at least 20 percent above baseline (HERS 70) and a near

zero-net percentage of at least 50 percent (HERS 45) where approximately 50 percent of annual energy used by the home will come from on-site renewable generation;

- Stimulate the installation of solar photovoltaic systems and solar water heaters in new homes;
- Stimulate energy efficiency standards that are higher than Environmental Protection Agency/Department of Energy, Energy Star Homes® performance standards;
- Stimulate construction of new homes that are inspected and tested to assure energy performance;
- Stimulate the installation of high efficiency heating and cooling systems, envelope, lighting, and fixed appliances (Energy Star® products);
- Assist sales agents with promoting and selling of zero-net energy homes;
- Provide information to help explain the benefits of zero-net home features;
- Train builder construction staff and sub-contractors in advanced building-science concepts to reach zero-net energy goals through improved design and installation practices, and through the installation of renewable energy devices;
- Increase homebuyer awareness and understanding of the benefits they receive from living in a zero-net energy home and how they can improve the performance of their home; and
- Educate builders who: 1) are not familiar with energy savings and on-site generation potential; 2) may be uncertain about zero-net energy performance; and 3) may be concerned about high initial costs for construction measures.

### **PRODUCTS AND SERVICES**

According to TEP, the ZEH Pilot Program would provide the following products and services:

- Promotion of builders and subdivisions that achieve zero-net energy levels of at least 50 percent;
- Builder and sub-contractor education and training;

- Educational and promotional materials for builders and new home buyers; and
- Homeowner or builder incentives for achieving increasing energy efficiency and zero-net energy levels as measured by a HERS index score of either  $\leq 70$  or  $\leq 45$ .

### **ZEH PILOT PROGRAM METHODOLOGY**

To determine the feasibility for a ZEH program, TEP developed a baseline simulation model of a new home; then several versions of the baseline model with increasing levels of energy efficiency; and finally several versions of the energy efficiency models with increasing levels of zero-net energy targets.

There were four stages of the study:

- Define and simulate a baseline home, reflecting current practice for new single family homes in Tucson, Arizona, as an approximate representative location for TEP territory. The home was modeled as all-electric.
- Define and simulate three homes with increasing levels of efficiency. The targets for the models were a 20 percent, 30 percent, and 35 percent reduction in annual energy use.
- Simulate three homes with increasing levels of zero-net energy by adding both solar water heating and solar PV. The targets for the models were 50 percent, 75 percent, and 100 percent zero-net energy levels. These models were based on either the 20 percent or the 35 percent energy efficiency home.
- Combine estimated demand and energy savings from all of the models, incremental costs over baseline costs, and other utility data to produce a benefit-cost test result for each model. This was done in the format of a Measure Analysis Sheet.

According to TEP, the baseline home simulation was an all-electric, 1,850 square-foot home in Tucson, Arizona. A combination of two sources was used to determine the level of efficiency in the baseline model: 1) the 2007 Enovity Report<sup>2</sup>, and 2) the 2006 International Energy Conservation Code for residential new construction. The models were developed using the eQuest™ simulation software which generates savings estimates. The homes were also modeled with REM/Rate simulation software that determines the HERS index the homes would achieve. TEP developed a total of nine cases; three of which were energy efficiency models, three zero-net models based on a 20 percent energy efficient house, and three zero-net models based on a 35 percent energy efficient home.

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<sup>2</sup> Residential Home Standards: Energy Analysis and DOE-2 Simulation, Prepared by Enovity, Inc. for Tucson Electric Power Company, February 12, 2007.

For the energy efficiency-only models, TEP set a goal of 20 percent, 30 percent, and 35 percent reduction in annual energy usage over the baseline model. In addition, TEP added the following energy efficiency measures to the baseline model to generate increasing levels of savings:

- **Orientation:** Orienting a house in a north-south direction. (Not normally achievable in a subdivision design and can usually only be applied to custom homes.)
- **Windows:** reducing total window area; increasing window area on south-facing wall to increase passive solar heating; and reducing glass heat transfer coefficient ("U-Value") and Solar Heat Gain Coefficient ("SHGC") value. The SHGC value indicates how well a window blocks the transmission of heat from sunlight and is expressed as a number between 0 and 1. The lower the SHGC of a window, the more efficiently it blocks the transmission of heat.
- **HVAC Measures:** Reducing infiltration, reducing duct leakage, heat pump quality installation, increasing heat pump Seasonal Energy Efficiency Ratio ("SEER") and Coefficient of Performance ("COP") or Heating Seasonal Performance Factor ("HSPF") values, and moving ducts into conditioned space. Running HVAC ductwork through air conditioned or semi-conditioned spaces avoids temperature extremes and allows the system to work more efficiently. SEER ratings reflect the ratio of cooling output to kWh used and measure efficiency over an entire cooling season.
- **Envelope:** Increasing thermal resistance values ("R-values") in walls and ceiling.
- **Lighting:** Reducing lighting power density.
- **Appliances:** Replacing standard fixed appliances with Energy Star® fixed appliances.

For the zero-net models, the estimated hourly outputs from a solar water heating system and a solar PV system were subtracted from the hourly total energy use of the 20 percent energy efficiency or 35 percent energy efficiency model results, providing the net hourly and annual use of the home. TEP estimated the solar output using PVWatts simulation software for the solar PV system. TEP also used an in-house built spreadsheet model for the solar water heating system. The coincident and non-coincident peak demand for each case was determined by the hourly model results.

### **BUDGET AND ENERGY SAVINGS**

TEP estimated only the additional incremental costs related to the promotion of the proposed multi-tiered approach. Table 3 and Table 4 below show the estimated ZEH Pilot Program budget over a three-year period, from 2010-2012. The estimated budget represents only the incremental increase in the approved budget for the existing Guarantee Homes Program.

Table 3

Year	2010	2011	2012
Financial Incentives	\$195,000	\$214,500	\$235,500
Total Direct Implementation	\$19,514	\$19,945	\$20,420
Total Marketing Allocation	\$7,921	\$8,713	\$9,584
Total Admin and O&M Cost Allocation	\$6,598	\$7,258	\$7,984
Total EM&V Cost Allocation	\$1,486	\$1,634	\$1,798
Total Program Budget (above GHP)	\$230,519	\$252,050	\$275,286

Table 4

Year	2010	2011	2012
Total Program Budget	\$230,519	\$252,050	\$275,286
Incentives	\$195,000	\$214,500	\$235,500
Admin Costs	\$35,519	\$37,550	\$39,786
Incentives as % of Budget	84.6%	85.1%	85.5%

The baseline home simulation model used by TEP has a consumption of 14,228 kWh per year and a HERS index of 90. With the addition of Tier 2 and Tier 3, energy consumption decreases and the HERS index improves as energy efficiency measures, efficient designs, and renewables are incorporated. Table 5 below compares the annual consumption, peak demand, and annual savings with the baseline model, the existing program (Tier 1), and the addition of Tier 2 and Tier 3.

Table 5

	Baseline Home Model	Existing Program Tier 1: HERS Index $\leq 85$	Proposed Tier 2: HERS Index $\leq 70$	Proposed Tier 3: HERS Index $\leq 45$
Modeled Annual Consumption (kWh)	14,228	13,142	11,355	4,770
Peak Demand-Coincident (kW)	5.72	4.4	3.75	2.54
Annual kWh Savings	n/a	1,086	2,873	9,458
Annual Peak kW Savings	n/a	1.32	1.97	3.18

- Tier 1 is the existing Guarantee Homes Program. Tier 1 has a qualifying HERS index of  $\leq 85$ . TEP did not include a re-analysis of this existing program in the ZEH Pilot Program.
- Tier 2 is the proposed new Guarantee Homes Plus program. Tier 2 has a qualifying HERS index of  $\leq 70$ . The Tier 2 home is modeled to be approximately 30 percent more efficient than the baseline home.
- Tier 3 is the proposed new Guarantee Homes Near Zero-Net. Tier 3 has a qualifying HERS index of  $\leq 45$ . The Tier 3 home is modeled to be approximately 50 percent zero-net energy and is based on the home that is approximately 50 percent more efficient than the baseline home model.

TEP anticipates a maximum of 100 participants in 2010, estimating that 70 percent would achieve the Tier 2 standard and 30 percent would achieve the Tier 3 standard. In addition, TEP is anticipating a 10 percent increase in participation per year. Participation in the existing GHP Program is not included in TEP's forecast. Table 6 below shows TEP's total participation goals and energy savings.

Table 6

Year	2010	2011	2012	Total
Tier 2 Participants-HERS Index $\leq 70$	70	77	85	232
Tier 3 Participants-HERS Index $\leq 45$	30	33	36	99
Tier 2 and Tier 3 Total Participants/year	100	110	121	331
Total Annual Energy Savings (MWh)	485	533	585	1,603

### **BENEFIT-COST ANALYSIS**

The Commission's 1991 Resource Planning Decision established the Societal Test as the methodology to be used for determining the cost-effectiveness of a DSM program. Under the Societal Test, in order to be cost-effective, the ratio of benefits to costs must be greater than one. That is, the incremental benefits to society of a program must exceed the incremental costs of having the program in place. The societal costs for a DSM program include the cost of the measure and the cost of implementing the program, excluding rebates. The societal benefits of a DSM program include the avoided demand and energy costs as well as the avoided environmental impacts, which are quantified, but do not have to be monetized. The projected environmental and estimated energy savings are discussed in the next section. Staff did not conduct a benefit-cost analysis of TEP's proposed Tier 3 option because, according to information provided by TEP, the only difference between the incremental costs to builders for a home that qualifies for TEP's Tier 2 and TEP's Tier 3 option is the costs for solar measures.

In its application, TEP included potential costs of complying with carbon dioxide (CO<sub>2</sub>) regulation in its benefit-cost calculations. TEP has estimated low, medium, and high carbon values of \$14, \$25, and \$43/ton respectively. Staff understands that the Commission has yet to make a determination as to the potential value of CO<sub>2</sub> or its inclusion in the calculation of the Societal Test. Staff conducted its benefit-cost analysis including and excluding the CO<sub>2</sub> values provided by TEP. Without any value of CO<sub>2</sub> included in its analysis, Staff has concluded that TEP's Tier 2 option for the ZEH Pilot Program is not cost-effective, with an incremental builder cost of \$3,995 and a benefit/cost ratio of 0.75. With the inclusion of a low CO<sub>2</sub> value, TEP's Tier 2 option is cost-effective with a benefit-cost ratio of 1.12.



**ENVIRONMENTAL AND ENERGY SAVINGS**

Table 7 below represents the estimated lifetime environmental savings from all of the ZEH Pilot Program homes projected to be built over a three-year period. These savings represent the incremental savings above the estimate for the TEP Tier 1 (existing program). Staff notes that the projected environmental savings listed below reflect a thirty-year lifespan for the qualified homes built under this program and that longer life spans would result in higher savings.

**Table 7**

Type of Emission	Savings
CO <sub>2</sub> (lbs)	61,384,136
NO <sub>x</sub> (lbs)	83,285
SO <sub>x</sub> (lbs)	69,026
Water (gals)	14,746,478

**RECOMMENDATIONS**

Staff makes the following recommendations concerning the TEP ZEH Pilot Program:

- Based upon Staff's typical review and analysis of the benefits and costs of TEP's application, Staff does not recommend that TEP's proposed ZEH Pilot Program, as discussed herein, be approved at this time. However, based upon Staff's analysis with the inclusion of the CO<sub>2</sub> value, TEP's proposed ZEH Pilot Program is cost-effective.
- Should the Commission decide to approve TEP's proposed ZEH Pilot Program with the inclusion of the CO<sub>2</sub> value, Staff recommends that TEP's proposed ZEH Pilot Program be approved as discussed herein as a step toward zero-net energy home standards. In addition, Staff recommends that TEP's proposed ZEH Pilot Program be approved until further order of the Commission. Further, if the Commission approves of TEP's proposed ZEH Pilot Program, Staff recommends that TEP include information regarding its ZEH Pilot Program in its compliance filing with the requirements established for the existing New Home Construction Program in Decision No. 70458. The information reported should be broken down by tier. In addition, the information and data reported for all of the tiers should include the following information:
  1. Progress toward the goal of zero-net energy homes;
  2. Information on whether incremental measure and program costs are conforming to expectations;

3. Data indicating whether the energy savings estimated for each tier have actually occurred and been verified in practice;
  4. Explanations and proposed solutions should be provided in cases where participation, incremental and program costs, or energy savings are significantly different than originally estimated.
  5. Any other information necessary for the Commission to understand the progress and status of the program; and
- In addition, should the Commission approve TEP's ZEH Pilot Program, Staff recommends that it be marketed to gas and electric loans and that forty-two months after the date of a Decision in this matter, TEP file, for Commission approval, an application to continue, modify, or terminate the ZEH Pilot Program. Staff believes that a forty-two month timeframe is reasonable for TEP to sufficiently implement the Pilot Program, measure the results, and file its application.



Steven M. Olea  
Director  
Utilities Division

SMO:CLA:lhmvJFW

ORIGINATOR: Candrea Allen

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**BEFORE THE ARIZONA CORPORATION COMMISSION**

KRISTIN K. MAYES  
Chairman  
GARY PIERCE  
Commissioner  
PAUL NEWMAN  
Commissioner  
SANDRA D. KENNEDY  
Commissioner  
BOB STUMP  
Commissioner

IN THE MATTER OF THE APPLICATION  
OF TUCSON ELECTRIC POWER  
COMPANY FOR APPROVAL OF ITS  
PROPOSED ZERO-NET ENERGY HOMES  
PILOT PROGRAM

DOCKET NOS. E-01933A-07-0402  
E-01933A-05-0650  
  
DECISION NO. \_\_\_\_\_  
ORDER

Open Meeting  
March 31 and April 1, 2010  
Phoenix, Arizona

BY THE COMMISSION:

FINDINGS OF FACT

1. Tucson Electric Power Company ("TEP" or "Company") is certificated to provide electric service as a public service corporation in the State of Arizona.

BACKGROUND

2. On June 30, 2009, TEP filed an application for approval of its proposed Zero-Net Energy Homes ("ZEH") Pilot Program. The proposed ZEH Pilot Program expands on the current New Home Construction Program marketed as the Guarantee Homes Program ("GHP") and approved by the Commission on August 6, 2008 (Decision No. 70458). In Decision No. 70628, the Commission required TEP to "build on its current residential energy efficiency program and prepare a report and proposed pilot project [and]...outline what Zero-Net technologies and incentives...can be incorporated into the Company's existing DSM programs."

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**PROGRAM DESCRIPTION**

3. TEP's proposed ZEH Pilot Program which is an expansion of the current New Home Construction Program ("Tier 1") incorporates two new tiers: Tier 2-Energy Efficient Home Construction ("Tier 2") and Tier 3-Near Zero-Net Energy Homes ("Tier 3") into the existing New Home Construction Program. According to TEP, incorporating the two additional tiers will help keep the program administrative costs down. TEP intends to merge the ZEH Pilot Program with the existing GHP. According to the proposed Program, homes will qualify for one of the three tiers in the program based on a Home Energy Rating System ("HERS")<sup>1</sup> Index score. The HERS awards a numerical value for gauging a home's performance. Higher performing homes achieve a lower HERS score. Tier 1 requires a HERS score that is less than or equal to 85, Tier 2 will require a HERS score that is less than or equal to 70, and Tier 3 will require a HERS score that is less than or equal to 45. Table 1 illustrates the HERS Index Scores for the Residential New Home Construction Program.

**Table 1**

Tier 1 (Existing Program)	HERS Index Score of $\leq 85$
Tier 2 (Energy Efficiency Only)	HERS Index Score of $\leq 70$
Tier 3 (50% Zero-Net Energy)	HERS Index Score of $\leq 45$

4. The proposed ZEH Pilot Program design will allow TEP to use existing delivery infrastructure and marketing to promote all three program tiers. According to TEP, although the proposed addition of Tier 2 and Tier 3 would improve the energy efficiency of the New Home Construction Program, they do not achieve 100 percent zero-net energy due to cost-effectiveness concerns. TEP defines the term *zero-net energy* as "the ratio between annual energy generated by the house through the on-site renewable devices to the total annual energy used by the house." Therefore, a home is considered to be a 75 percent ZEH if 75 percent of the total annual energy a home uses (including energy from both gas and electric for dual fuel homes) comes from on-site generation.

5. TEP's existing residential New Home Construction Program currently offers three options; the Guarantee Homes Program ("GHP"), the Guarantee Solar Program ("GSP"), and the

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<sup>1</sup> The HERS Index was developed by the Residential Energy Service Network.

Energy Star® Program ("ESP"). TEP anticipates that the GSP will be replaced by the new Tier 3 option.

6. According to TEP, with the addition of the new Tier 2 and Tier 3 options, there will be additional construction standards in order for builders to achieve Tier 2 and Tier 3. As a result, the incremental costs for builders will increase to meet the increased standards for Tier 2 and Tier 3 as well as the recommended incentive to the builders. Table 2 illustrates the proposed ZEH Pilot Program Builder Incentives. The additional construction standards for Tier 2 and Tier 3 homes include:

- Greater envelope and Heating, Ventilating, and Air Conditioning ("HVAC") energy efficiency standards;
- Ducts are located within conditioned space;
- Both photovoltaic ("PV") and solar water heating on the ZEH;
- Passive solar design that incorporates passive solar heating in the winter and shading in the summer for the highest efficiency homes;
- Energy Star® fixed appliances; and
- Compact Fluorescent Lamps ("CFLs")

Table 2

ZEH Tier Level	HERS Index	Builder Incentive
Tier 1 (Existing Program)	≤ 85	\$400 per home
Tier 2 (Energy Efficiency Home)	≤ 70	\$1,500 per home
Tier 3 (50% Zero-Net Energy Homes)	≤ 45	\$3,000 per home

7. According to information provided by TEP, the additional \$1,500 above Tier 2 incentive paid to builders for Tier 3 from this program will be in addition to the incentives paid from TEP's REST Program. Despite the addition of the \$1,500 increase in incentives between Tier 2 and Tier 3, the total incentives paid for Tier 3 will not exceed the sixty percent (60%) cap approved in its 2010 REST Implementation Plan (Decision No. 71465). TEP indicated that builders would not pursue the available federal and state tax credits for PV and solar water heaters as they may not be eligible to receive those credits because the builder would not be the actual owner of the home. In addition, TEP indicated that the actual home owner would be eligible to

1 pursue the available federal and state credits for PV and solar water heaters. Therefore, TEP chose  
2 to increase the incentive levels for those builders who invested in the construction of a home that  
3 qualifies for the Tier 3 level ( $\text{HERS} \leq 45$ ) because the builder may not be able to qualify for the  
4 available federal and state tax credits for solar technologies.

#### 5 TARGET MARKET

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8 its service territory. The tiered program approach allows TEP to promote the Tier 2 level of the  
9 ZEH Pilot Program for homes that are constructed with a combination of electric and natural gas.

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11 designed for a 50 percent zero-net energy level (Tier 3), the size of the PV system built would  
12 need to be large enough to produce at least 50 percent of the total energy (gas and/or electric) used  
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17 However, Staff believes that for Tier 3 that TEP's marketing efforts should include gas/electric  
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#### 19 PROGRAM OBJECTIVES

20 10. The objectives of the ZEH Pilot Program are the following:

- 21 • Reduce peak demand and overall energy consumption (electric) in new homes;
- 22 • Implement programs that include more aggressive energy efficiency standards that  
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24 net percentage of at least 50 percent (HERS 45) where approximately 50 percent of  
25 annual energy used by the home will come from on-site renewable generation;
- 26 • Stimulate the installation of solar photovoltaic systems and solar water heaters in  
27 new homes;
- 28 • Stimulate energy efficiency standards that are higher than Environmental Protection  
Agency/Department of Energy, Energy Star Homes® performance standards;

- Stimulate construction of new homes that are inspected and tested to assure energy performance;
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- Educate builders who: 1) are not familiar with energy savings and on-site generation potential; 2) may be uncertain about zero-net energy performance; and 3) may be concerned about high initial costs for construction measures.

#### **PRODUCTS AND SERVICES**

11. According to TEP, the ZEH Pilot Program would provide the following products and services:

- Promotion of builders and subdivisions that achieve zero-net energy levels of at least 50 percent;
- Builder and sub-contractor education and training;
- Educational and promotional materials for builders and new home buyers; and
- Homeowner or builder incentives for achieving increasing energy efficiency and zero-net energy levels as measured by a HERS index score of either  $\leq 70$  or  $\leq 45$ .

#### **ZEH PILOT PROGRAM METHODOLOGY**

12. To determine the feasibility for a ZEH program, TEP developed a baseline simulation model of a new home; then several versions of the baseline model with increasing levels of energy efficiency; and finally several versions of the energy efficiency models with increasing levels of zero-net energy targets.

13. There were four stages of the study:

- Define and simulate a baseline home, reflecting current practice for new single family homes in Tucson, Arizona, as an approximate representative location for TEP territory. The home was modeled as all-electric.
- Define and simulate three homes with increasing levels of efficiency. The targets for the models were a 20 percent, 30 percent, and 35 percent reduction in annual energy use.
- Simulate three homes with increasing levels of zero-net energy by adding both solar water heating and solar PV. The targets for the models were 50 percent, 75 percent, and 100 percent zero-net energy levels. These models were based on either the 20 percent or the 35 percent energy efficiency home.
- Combine estimated demand and energy savings from all of the models, incremental costs over baseline costs, and other utility data to produce a benefit-cost test result for each model. This was done in the format of a Measure Analysis Sheet.

14. According to TEP, the baseline home simulation was an all-electric, 1,850 square-foot home in Tucson, Arizona. A combination of two sources was used to determine the level of efficiency in the baseline model: 1) the 2007 Enovity Report<sup>2</sup>, and 2) the 2006 International Energy Conservation Code for residential new construction. The models were developed using the eQuest™ simulation software which generates savings estimates. The homes were also modeled with REM/Rate simulation software that determines the HERS index the homes would achieve. TEP developed a total of nine cases; three of which were energy efficiency models, three zero-net models based on a 20 percent energy efficient house, and three zero-net models based on a 35 percent energy efficient home.

15. For the energy efficiency-only models, TEP set a goal of 20 percent, 30 percent, and 35 percent reduction in annual energy usage over the baseline model. In addition, TEP added the following energy efficiency measures to the baseline model to generate increasing levels of savings:

- **Orientation:** Orienting a house in a north-south direction. (Not normally achievable in a subdivision design and can usually only be applied to custom homes.)

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<sup>2</sup> Residential Home Standards: Energy Analysis and DOE-2 Simulation, Prepared by Enovity, Inc. for Tucson Electric Power Company, February 12, 2007.



- **Windows:** reducing total window area; increasing window area on south-facing wall to increase passive solar heating; and reducing glass heat transfer coefficient ("U-Value") and Solar Heat Gain Coefficient ("SHGC") value. The SHGC value indicates how well a window blocks the transmission of heat from sunlight and is expressed as a number between 0 and 1. The lower the SHGC of a window, the more efficiently it blocks the transmission of heat.
- **HVAC Measures:** Reducing infiltration, reducing duct leakage, heat pump quality installation, increasing heat pump Seasonal Energy Efficiency Ratio ("SEER") and Coefficient of Performance ("COP") or Heating Seasonal Performance Factor ("HSPF") values, and moving ducts into conditioned space. Running HVAC ductwork through air conditioned or semi-conditioned spaces avoids temperature extremes and allows the system to work more efficiently. SEER ratings reflect the ratio of cooling output to kWh used and measure efficiency over an entire cooling season.
- **Envelope:** Increasing thermal resistance values ("R-values") in walls and ceiling.
- **Lighting:** Reducing lighting power density.
- **Appliances:** Replacing standard fixed appliances with Energy Star® fixed appliances.

16. For the zero-net models, the estimated hourly outputs from a solar water heating system and a solar PV system were subtracted from the hourly total energy use of the 20 percent energy efficiency or 35 percent energy efficiency model results, providing the net hourly and annual use of the home. TEP estimated the solar output using PVWatts simulation software for the solar PV system. TEP also used an in-house built spreadsheet model for the solar water heating system. The coincident and non-coincident peak demand for each case was determined by the hourly model results.

### **BUDGET AND ENERGY SAVINGS**

17. TEP estimated only the additional incremental costs related to the promotion of the proposed multi-tiered approach. Table 3 and Table 4 below show the estimated ZEH Pilot Program budget over a three-year period, from 2010-2012. The estimated budget represents only the incremental increase in the approved budget for the existing Guarantee Homes Program.

**Table 3**

Year	2010	2011	2012
Financial Incentives	\$195,000	\$214,500	\$235,500

Total Direct Implementation	\$19,514	\$19,945	\$20,420
Total Marketing Allocation	\$7,921	\$8,713	\$9,584
Total Admin and O&M Cost Allocation	\$6,598	\$7,258	\$7,984
Total EM&V Cost Allocation	\$1,486	\$1,634	\$1,798
<b>Total Program Budget (above GHP)</b>	<b>\$230,519</b>	<b>\$252,050</b>	<b>\$275,286</b>

**Table 4**

Year	2010	2011	2012
Total Program Budget	\$230,519	\$252,050	\$275,286
Incentives	\$195,000	\$214,500	\$235,500
Admin Costs	\$35,519	\$37,550	\$39,786
<b>Incentives as % of Budget</b>	<b>84.6%</b>	<b>85.1%</b>	<b>85.5%</b>

18. The baseline home simulation model used by TEP has a consumption of 14,228 kWh per year and a HERS index of 90. With the addition of Tier 2 and Tier 3, energy consumption decreases and the HERS index improves as energy efficiency measures, efficient designs, and renewables are incorporated. Table 5 below compares the annual consumption, peak demand, and annual savings with the baseline model, the existing program (Tier 1), and the addition of Tier 2 and Tier 3.

**Table 5**

	Baseline Home Model	Existing Program Tier 1: HERS Index $\leq 85$	Proposed Tier 2: HERS Index $\leq 70$	Proposed Tier 3: HERS Index $\leq 45$
Modeled Annual Consumption (kWh)	14,228	13,142	11,355	4,770
Peak Demand-Coincident (kW)	5.72	4.4	3.75	2.54
Annual kWh Savings	n/a	1,086	2,873	9,458
Annual Peak kW Savings	n/a	1.32	1.97	3.18

- Tier 1 is the existing Guarantee Homes Program. Tier 1 has a qualifying HERS index of  $\leq 85$ . TEP did not include a re-analysis of this existing program in the ZEH Pilot Program.
- Tier 2 is the proposed new Guarantee Homes Plus program. Tier 2 has a qualifying HERS index of  $\leq 70$ . The Tier 2 home is modeled to be approximately 30 percent more efficient than the baseline home.
- Tier 3 is the proposed new Guarantee Homes Near Zero-Net. Tier 3 has a qualifying HERS index of  $\leq 45$ . The Tier 3 home is modeled to be approximately 50 percent

zero-net energy and is based on the home that is approximately 50 percent more efficient than the baseline home model.

19. TEP anticipates a maximum of 100 participants in 2010, estimating that 70 percent would achieve the Tier 2 standard and 30 percent would achieve the Tier 3 standard. In addition, TEP is anticipating a 10 percent increase in participation per year. Participation in the existing GHP Program is not included in TEP's forecast. Table 6 below shows TEP's total participation goals and energy savings.

Table 6

Year	2010	2011	2012	Total
Tier 2 Participants-HERS Index $\leq 70$	70	77	85	232
Tier 3 Participants-HERS Index $\leq 45$	30	33	36	99
Tier 2 and Tier 3 Total Participants/year	100	110	121	331
Total Annual Energy Savings (MWh)	485	533	585	1,603

#### **BENEFIT-COST ANALYSIS**

20. The Commission's 1991 Resource Planning Decision established the Societal Test as the methodology to be used for determining the cost-effectiveness of a DSM program. Under the Societal Test, in order to be cost-effective, the ratio of benefits to costs must be greater than one. That is, the incremental benefits to society of a program must exceed the incremental costs of having the program in place. The societal costs for a DSM program include the cost of the measure and the cost of implementing the program, excluding rebates. The societal benefits of a DSM program include the avoided demand and energy costs as well as the avoided environmental impacts, which are quantified, but do not have to be monetized. The projected environmental and estimated energy savings are discussed in the next section. Staff did not conduct a benefit-cost analysis of TEP's proposed Tier 3 option because, according to information provided by TEP, the only difference between the incremental costs to builders for a home that qualifies for TEP's Tier 2 and TEP's Tier 3 option is the costs for solar measures.

21. In its application, TEP included potential costs of complying with carbon dioxide (CO<sub>2</sub>) regulation in its benefit-cost calculations. TEP has estimated low, medium, and high carbon

values of \$14, \$25, and \$43/ton respectively. Staff understands that the Commission has yet to make a determination as to the potential value of CO<sub>2</sub> or its inclusion in the calculation of the Societal Test. Staff conducted its benefit-cost analysis including and excluding the CO<sub>2</sub> values provided by TEP. Without any value of CO<sub>2</sub> included in its analysis, Staff has concluded that TEP's Tier 2 option for the ZEH Pilot Program is not cost-effective, with an incremental builder cost of \$3,995 and a benefit/cost ratio of 0.75. With the inclusion of a low CO<sub>2</sub> value, TEP's Tier 2 option is cost-effective with a benefit-cost ratio of 1.12.

### **ENVIRONMENTAL AND ENERGY SAVINGS**

22. Table 7 below represents the estimated lifetime environmental savings from all of the ZEH Pilot Program homes projected to be built over a three-year period. These savings represent the incremental savings above the estimate for the TEP Tier 1(existing program). Staff notes that the projected environmental savings listed below reflect a thirty-year lifespan for the qualified homes built under this program and that longer life spans would result in higher savings.

Table	
Type of Emission	Savings
CO <sub>2</sub> (lbs)	61,384,136
NO <sub>x</sub> (lbs)	83,285
SO <sub>x</sub> (lbs)	69,026
Water (gals)	14,746,478

### **RECOMMENDATIONS**

23. Staff has made the following recommendations concerning the TEP ZEH Pilot Program:

- Based upon Staff's typical review and analysis of the benefits and costs of TEP's application, Staff has not recommended that TEP's proposed ZEH Pilot Program, as discussed herein, be approved at this time. However, based upon Staff's analysis with the inclusion of the CO<sub>2</sub> value, TEP's proposed ZEH Pilot Program is cost-effective.
- Should the Commission decide to approve TEP's proposed ZEH Pilot Program with the inclusion of the CO<sub>2</sub> value, Staff has recommended that TEP's proposed ZEH Pilot Program be approved as discussed herein as a step toward zero-net energy home standards. In addition, Staff has recommended that TEP's proposed ZEH Pilot Program be approved until further order of the Commission. Further, if the Commission approves of TEP's proposed ZEH Pilot Program, Staff has recommended that TEP include information regarding its ZEH Pilot Program in its

1 compliance filing with the requirements established for the existing New Home  
2 Construction Program in Decision No. 70458. The information reported should be  
3 broken down by tier. In addition, the information and data reported for all of the tiers  
4 should include the following information:

- 5 1. Progress toward the goal of zero-net energy homes;
- 6 2. Information on whether incremental measure and program costs are conforming  
7 to expectations;
- 8 3. Data indicating whether the energy savings estimated for each tier have actually  
9 occurred and been verified in practice;
- 10 4. Explanations and proposed solutions should be provided in cases where  
11 participation, incremental and program costs, or energy savings are significantly  
12 different than originally estimated.
- 13 5. Any other information necessary for the Commission to understand the progress  
14 and status of the program; and

- 15 • In addition, should the Commission approve TEP's ZEH Pilot Program, Staff has  
16 recommended that it be marketed to gas/electric homes and that forty-two months  
17 after the date of a Decision in this matter, TEP file, for Commission approval, an  
18 application to continue, modify, or terminate the ZEH Pilot Program. Staff believes  
19 that a forty-two month timeframe is reasonable for TEP to sufficiently implement the  
20 Pilot Program, measure the results, and file its application.

#### 21 CONCLUSIONS OF LAW

22 1. TEP is an Arizona public service corporation within the meaning of Article XV,  
23 Section 2, of the Arizona Constitution.

24 2. The Commission has jurisdiction over TEP and over the subject matter of the  
25 Application.

26 3. The Commission, having reviewed the application and Staff's Memorandum dated  
27 March 16, 2010, concludes that it is not in the public interest to approve the TEP request for  
28 approval of its Zero-Net Energy Homes Pilot Program.

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ORDER

IT IS THEREFORE ORDERED that Tucson Electric Power Company's request for approval of its Zero-Net Energy Homes Pilot Program be and hereby is denied.

IT IS FURTHER ORDERED that this Order shall become effective immediately.

**BY THE ORDER OF THE ARIZONA CORPORATION COMMISSION**

CHAIRMAN

COMMISSIONER

COMMISSIONER

COMMISSIONER

COMMISSIONER

IN WITNESS WHEREOF, I, ERNEST G. JOHNSON, Executive Director of the Arizona Corporation Commission, have hereunto, set my hand and caused the official seal of this Commission to be affixed at the Capitol, in the City of Phoenix, this \_\_\_\_\_ day of \_\_\_\_\_, 2010.

ERNEST G. JOHNSON  
EXECUTIVE DIRECTOR

DISSENT: \_\_\_\_\_

DISSENT: \_\_\_\_\_

SMO:CLA:lhmvJFW

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